

Developing your Web presence

The exercise of power is determined by thousands of interactions between the world of the powerful and that of the powerless, all the more so because these worlds are never divided by a sharp line: everyone has a small part of himself in both - Vaclav Havel

THURSDAY, MAY 24, 2007

A Coffee Can Foundry... (making bronze, part 2)

In this previous post I outlined a plan to make home-made bronze, using a so-called coffee can foundry. Here I'll show the first results of some aluminium and copper melting attempts.

I switched to barbecue briquettes instead of simple charcoal, more by accident than by design (wrong purchase!), but it worked out rather well. The briquettes are higher in density and pack more carbon (the fuel!) than ordinary charcoal per unit of volume. Broken up into roughly 1 cm pieces and used as previously, the burning rate and furnace heat seemed comparable but burning time appeared more than doubled.

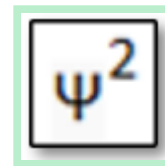


Here's the furnace during firing:



The first aluminium mini-ingot:

About Me



Name:

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Born to Annoy: Liberals, Conservatives and RINOs alike!

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Another aluminium ingot:



The top ingot weighs 6.5 g and was obtained from 14.2 g of aluminium take-away food trays.

While in the previous post I suggested cutting up the aluminium material into small pieces, on second thought this was *really not the way to go*. It's better to hammer the material into a tight and compact chunk, preferably one that fits the crucible snugly. This way heat will be transferred to the metal quickly (thereby saving time). Metals are excellent heat conductors (aluminium is almost "best in class" on that point) and the chunk will quickly heat throughout. Smaller pieces separated by air will take a little longer to heat through due to the insulation provided by the air. Higher surface area will also lead to more oxidation of the aluminium (see below), leading to more dross. The ingots above were both obtained from compact chunks of aluminium material. The molten aluminium was "cast" simply onto dry beach sand.

The bottom one (here compared to a 2 pence coin) weighed 22 g and came from 24 g of similar material.

The loss is mainly due to the formation of *dross*, in the case of "clean" (uncoated or unpainted) aluminium from [passivation](#). The surface of the hot aluminium reacts with oxygen and forms aluminium oxide, which creates a skin on the melt, *very similar to the skin often found on boiled milk*. It makes casting rather difficult and can only be removed from larger melts by *skimming the dross off*. But casting metals isn't really my priority right now...

At the end of the melt and cast that yielded the second ingot, the furnace was still going strong and I added a few brass (97 w% of copper) coins (checked with a magnet: some "copper" coins are actually copper coated steel) and reinserted the crucible. The coins heated up to a dull red glow but *didn't melt*. Unfortunately they weren't given much time as the inevitable happened: the thin-walled steel can crucible finally burned through. Having withstood 5 or 6 intense onslaughts of heat and air, it's rather a surprise it lasted that long; the steel had been literally burning

away slowly, forming *iron oxide* (better known as *rust*).

So, on whether the furnace reaches the required 1084 DC to melt copper, the jury is still out...

Update:

Based on the fact that the furnace burns about 90 g of carbon (3 charcoal briquettes) in 10 minutes, the power generated is about 5 kW ($5,000\text{ W}$), or five times the power of a high range domestic microwave oven. Not bad for such a dingy construction!

But that doesn't solve the copper melting problem. To better establish the temperature obtained in the crucible, I decided to try and melt some ordinary kitchen salt (chemically: [sodium chloride](#)) which has a *melting point of 801 DC*. I charged the (new) crucible with 30 g of salt and fired up the furnace. The salt melted but only just, see photo below:



A small chunk of salt remained solid (not molten), indicating the temperature inside the crucible must have been very close to the melting point of the salt. The salt proved uncastable as it re-solidified immediately after removing the crucible from the heat. I later prized the salt out of the crucible and it showed a clear imprint from the crucible bottom. A piece of re-solidified salt (blackened by the burning can-coating) can be seen on the right side of the picture below:



So, the good news is that my initial estimate (based on glow colour) of 800 DC was pretty accurate but the bad news is that that is *about 200 DC short of the melting points of copper, brass and bronze!* To increase the temperature as much as possible I will now try two approaches combined:

1. Using a tightly fitting lid made of the proven Perlite/fire cement refractory material, to prevent heat loss through convection and radiation.
2. Prolonged firing of the furnace by means of "in-flight refuelling". By adding about 1 1/2 briquette to the fire about every 5 minutes, it should be possible to fire the furnace almost continuously, thereby reaching a higher equilibrium temperature than obtained so far.

Although the object of these experiments isn't really to cast metals, I kind of got the taste of it and I like it. So I decided to make another ingot, somewhat larger and cast into an actual mould (an inverted *corned beef tin*), using the mixed aluminium material (45 g) shown in the middle of the picture above (left is some lead metal from car wheels, for a later melt).

Again, the *dross* played up and casting was difficult: the resulting ingot can be seen below. The dross simply dropped out of the crucible and onto the casting! It's clear that to melt aluminium waste (coated and painted) that generates considerable amounts of dross, it's necessary to have a bath of at least 100 - 150 g of "clean" aluminium melt, into which the waste can then be dropped. The waste should melt quickly (a bit like dropping ice cubes into hot water) and that removing the dross by skimming should then be easier. *But for this continuous operation of the furnace is a must...*



Here's the third instalment on work on the foundry

posted by Gert @ 7:45 PM

[3 comments](#)



3 Comments:

At [9:21 AM](#),  [Eitan Ha'ahzari](#) said...

All this chemical experimenting has got me dizzy. This stuff is WAY over my head. In short, you've been nominated for the Emmys, the Pulitzer Prize and the Nobel Peace Prize all at once. I mean, if Arafat got it...

At [1:56 PM](#),  [Gert](#) said...

Eitan:

Well, you must be easily dizzied because this has been mainly some low level physics, hardly any chemistry at all. But if you're even remotely interested in how bronze can be made, then keep looking out for more posts shortly.

At [4:58 PM](#),  [Eitan Ha'ahzari](#) said...

I just did and apparently I'm still dizzied.

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